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Sense of coherence and social support predict living liver donors' emotional stress prior to living-donor liver transplantation

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Abstract: The protection of the donors from physical or emotional harm has been a fundamental principle in living-donor liver donation from the beginning. Psychosomatic donor evaluation aims at the selection of eligible donors and the screening and exclusion of psychiatrically vulnerable donors. As clinical interviews may include subjective biases, efforts should be made to establish objective criteria for donor assessment. In recent research, protective factors have been reported to be a significant force behind healthy adjustment to life stresses and can be investigated as possible predictors of donors' eligibility. Being the central construct of Antonovsky's theory of salutogenesis, the sense of coherence is one of the most surveyed protective factors and a good predictor of individuals' stability when experiencing stress. Furthermore, family support has been shown to be a valuable protective resource in coping with stress. This study surveyed whether sense of coherence and social support predict donors' emotional strain prior to transplantation. Seventy-one donor candidates were included in the study during the donor evaluation prior to living-donor liver transplantation. Sense of coherence proved to be a significant predictor for all criterion variables, namely anxiety, depression and mental quality of life. In addition to this, donor candidates who were classified as eligible for donation in the psychosomatic interview had significantly higher values on sense of coherence total scores compared with rejected donors. In a multiple regression analysis, sense of coherence and social support together yielded a prediction of depression with an explained variance of 22% ($R^2 = 0.22$). Sense of coherence and social support can be implemented as self-rating instruments in the psychosomatic selection of donors and would help to further objectify donors' eligibility.

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The method of living-donor liver transplantation (LDLT) was first developed as one possibility to overcome the shortage of donor organs available for children by providing living liver donations through a family member (1). In recent years, a remarkable increase in adult LDLT could be observed, as approximately 10% of all liver transplants in the United States (2) and 8% of liver transplants in Germany (3) were living liver donations for children and adults.

A comprehensive medical evaluation of donors is a relevant prerequisite for LDLT. Living-donor transplantation offers an essential source of organs, but considerable time and effort are required to select eligible donors (4). Donor selection has been pointed out as a remarkable limitation factor of LDLT (5, 6). As our institution (Essen transplant center) routinely offers living liver donation in the treatment of liver insufficiency in the end stage, it was important for us to

establish a sound and standardized psychosomatic evaluation of the donors (7). Most authors, like Olbrisch et al. (8) and Shrestha (9) consider the informed consent, motivation for donating, the decision-making process, the adequacy of financial and social support, behavioral and psychological health, and the donor–recipient relationship as the primary domains to be assessed in the psychosocial evaluation. Anderson-Shaw et al. (10) see an ethical necessity of supporting the donors during the decision-making process by a donor advocate.

In a previous survey at our center (11), 27 (13.2%) of the donor candidates were rejected in the psychosomatic evaluation. The exclusion rate for psychosocial reasons ranged from 2% to 15% in other transplant centers. The number of patients (candidates) rejected for psychosocial reasons, defined as ambivalence, insufficient social support, psychological distress, and prior history of mental disorders, reported by various authors are as follows: Sterneck et al. (5), six (8%) of 73 patients; Baker et al. (12), one patient (2%, n = 64); Renz et al. (13), six patients (8%, n = 75); Beavers et al. (14), 12% (n = 161). Walter et al. (15) reported that seven (15%) of 47 donors for pediatric and adult LDLT were excluded because of high anxiety and ambivalence. Fukunishi et al. (16) surveyed psychiatric disorders before and after living-donor transplantation and ascertained a fivefold higher prevalence of pretransplant psychiatric disorders among donors for adult LDLT when compared with pediatric donors.

There is little knowledge about relationships between eligibility criteria and significant predictors of psychological strain in living donation candidates. On the other hand, resources that protect against the development of psychiatric disturbances are reported to be a crucial force behind healthy adjustment to life stresses and can be investigated as possible predictors of donors' eligibility. Resilience means the individual's capacity to cope with stressors, such as disease or trauma, or to recover from it. It also indicates the psychological ability to resist negative events as a protective factor for mental health (17–19). Being the central construct of Antonovsky's theory of salutogenesis (20), sense of coherence is one of the most surveyed factors of resilience. Recent studies (17–21) ascertained that sense of coherence can be considered as an important resilience factor for mental health. An individual with a strong sense of coherence has the ability to define life events as less stressful (comprehensibility), to mobilize resources to deal with encountered stressors (manageability), and to possess the motivation, desire, and commitment to cope (meaningfulness) (20). Antonovsky describes sense of coherence as a capacity that develops over time, beginning from young adulthood and being fairly stable between the ages of 20 and 30 yr (20, 22).

Recently, sense of coherence impact on caregivers' stress adaptation has been investigated in families with seriously ill or handicapped members. In spouses of cardiac patients prior to heart transplantation (23), in families with a child with asthma (24), in mothers with deaf and hard-of-hearing children (25), sense of coherence reduced reported stress and improved the quality of life. Furthermore, after prostate cancer (26) and for stroke caregivers (27), the most influential factor on quality of life was sense of coherence. Therefore, we presumed that sense of coherence would be a significant predictor of perceived distress and mental quality of life in live liver donors who have a similar relationship to their recipients as the family caregivers mentioned earlier. Furthermore, living donors are not only exposed to the caregiver burden, but have to undergo a potentially life-threatening surgical procedure, and sense of coherence could play a relevant role in helping them to cope with this critical life event.

Another important protective factor for mental health is social support (28, 29). Social support is an effective buffering factor when people are under distress (29) and has a positive influence on the immune, neuroendocrine, and cardiovascular system (30–32). The positive impact of social support on coping and health behavior has been verified for patients with chronic illness like coronary heart disease (31), multiple sclerosis (32), and transplant patients (33). It is to assume that social support reduces the donor candidates' perceived stress.

Objectives

Sense of coherence and social support could be employed as objective measurements in the selection of donor candidates for LDLT, if they have a predictive value. The goal of this study was to research the influence of the sense of coherence and social support on the perceived anxiety, depression, and mental quality of life of the donors prior to LDLT. We hypothesized that higher levels of sense of coherence and social support would be related to higher mental quality of life and lower levels of anxiety and depression, and that sense of coherence and social support would be able to predict the latter variables. Furthermore, the group of eligible donors was expected to have higher scores of sense of coherence and higher social support than the rejected donors.

Patients and methods

In a cross-sectional design, we examined potential donors at the Transplantation Center of the University Hospital Essen, who were admitted to the Department of Psychosomatic Medicine for a psychosomatic screening. All protocols of the survey were reviewed and approved by the Medical Faculty's Ethical Committee (02-2030). During the psychological interviews, patients were asked to take part in the study and were enrolled after they had given their written informed consent. Two sources of information from the time point of donor evaluation before transplantation were included in the study. First, there are the results of the psychosomatic evaluation of the donors with a final judgment about their eligibility and the psychiatric diagnoses. Second, data sources are the donors' self ratings, including anxiety, depression, mental quality of life, sense of coherence, and social support. The experts were not informed about the results of the self ratings. The study explored if the self-rated sense of coherence and social support as moderator variables were correlated with the experts' eligibility ratings and if they predicted self-rated anxiety, depression, and social quality of life.

Sample

The sample included donors who were evaluated for an adult or pediatric LDLT from February 2004 to April 2006 in our transplant centre. The steps of the donors' medical (6) and psychosomatic evaluation (7, 11, 34) have been described in previous publications. Inclusion criteria were a good command of the German language and a permanent residence status in Germany. Ninety-two potential donors were asked to participate in the study – 71 candidates (77%, five donor candidates for pediatric and 66 for adult LDLT) agreed and were included. Remaining donors rejected to participate owing to following reasons: lacking motivation (four donors); ongoing stressful situation in their family (10 donors) because the recipient was transplanted with a deceased organ (four donors) and that they did not feel like "real donors"; and without explaining any reasons (three donors).There were no group differences of age, gender, and prevalence of psychiatric disorders between the groups of participating and nonparticipating donors. Those 71 candidates were evaluated for a total of 59 recipients.

Subgroups

After the psychosomatic interview, donor candidates were classified into two groups, namely: accepted (n = 59) and rejected candidates (n = 12). The reasons for exclusion were lacking mental stability, continuous indecisiveness or ambivalence, and finally, perceived coercion through family. Psychiatric diagnoses according to ICD-10 (35) and other reasons of exclusion are depicted in Table 1.

Questionnaires and analysis strategy

Hospital Anxiety and Depression Scale, German version (HADS-D) (36). The HADS is an international widely used screening instrument to assess anxiety and depression in physically ill persons (36, 37). It consists of 14 items; seven are related to the

Table 1. Rejected patients (n = 12)

Age (yr)	Gender	Donation for	Diagnoses	Reasons of exclusion
49	F	Brother		Conflict of ambivalence
31	M	Mother		Conflict of ambivalence
26	M	Mother		Conflict of ambivalence
21	M	Adoptive father		Medical excuse
42	F	Husband		Medical excuse
38	M	Brother	F 60.6 Anxious [avoidant] personality disorder F50.3 Atypical bulimia nervosa	Lacking mental stability
36	F	Child	F41.1 Generalized anxiety disorder F60.1 Schizoid personality disorder F43.1 Post-traumatic stress disorder	Lacking mental stability
45	F	Husband	F32.1 Moderate depressive episode F17.2 Nicotine dependence syndrome	Lacking mental stability
46	F	Wife	F43.21 Depressive adjustment disorder	Lacking mental stability
51	F	Wife	F60.3 Emotionally unstable personality disorder: Borderline type	Lacking mental stability
24	F	Cousin	F45.0 Somatization disorder	Lacking mental stability
32	F	Friend	F43.0 Acute stress reaction	Lacking mental stability

anxiety and further seven items to the depression subscale. Scores up to 7 are considered normal, 8–10 borderline and scores of 11 and more indicate clinical caseness. The validity and reliability (Cronbach's alpha 0.80 for anxiety and 0.80 for depression) for health settings and among the general population is confirmed by previous studies. This questionnaire was applied because it measures only mental and not physical symptoms of depression; an overlapping of bodily complaints could therefore be excluded.

Short-form 36-Item health survey, German version (SF-36) (38). The SF-36 is an international commonly used self-assessment questionnaire of psychological, physical, and social aspects of quality of life (38, 39). It contains 36 items and measures eight domains of physical and mental health: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, psychological well being. In addition to the scores of the eight subscales, a mental and a physical composite score can be generated. The instrument is considered reliable, valid and sensitive to change.

Sense of Coherence Scale, German version (SOC-29) (40). This questionnaire consists of 29 seven-point Likert-type items, measuring the subscale comprehensibility, manageability, and meaningfulness. The higher the total score of the SOC, the stronger is the sense of coherence. Validity and reliability were confirmed in previous studies (40), and German norm values are available (41). The total scale values of the SOC have been found to be more reliable and valid than subscale scores (18, 42). Therefore, only the overall scale of the SOC was included in our calculations.

Social support questionnaire (F-SOZU) (43). This questionnaire is a widely used German self-report questionnaire with 54 items for the assessment of social support in four major scales (''emotional support,'' ''instrumental support,'' ''social integration,'' and ''social strain'') and a global scale. It records individual experiences regarding socially supportive relationships, problematic support, and the anticipated social support. Reliability (Cronbach's alpha between 0.81 and 0.93) and validity were tested in different samples and German norm values are available (43).

Statistical analysis

Data were registered and analyzed using the Statistical Package for Social Sciences, version 13.0 (SPSS Inc., Chicago, IL, USA). For descriptive analysis, data were expressed as mean values and standard deviations. Comparisons between the sample and norm values were performed using one-sample *t*-tests. To analyze the bivariate relationships between the dependent (mental quality of life, anxiety, and depression) and independent variables (sense of coherence and social support), Pearson and Spearman correlations were conducted. A series of multiple hierarchical regression analyses was calculated to quantify the relative contribution of the sense of coherence and social support in the prediction of the criterion variables to detect the predictors for mental stability. For all tests, a significance level of $p < 0.05$ was predetermined.

Results

Demographic characteristics

Demographic characteristics of the study participants are shown in Table 2. The total sample consisted of 71 participants – 42 (59%) men and 29 (41%) women ($\chi^2 = 2.38$; $p = 0.12$) – who ranged in age from 19 to 58 yr. The mean age of all participants was 36.01 yr (SD 10.3). In terms of family status, 30 (42.3%) patients were single, 38 (53.5%) married, two (2.8%) were separated or divorced and one (1.4%) was widowed at the time of study participation. There were significantly more women in the group of rejected candidates ($\chi^2 = 5.05$; $p = 0.02$). There were no differences

Table 2. Demographics

	Donor candidates (n = 71)	Eligible donors (n = 59)	Rejected donors (n = 12)
Age in years (range)	36.01 (19–58)	36.53 (20–58)	35.5 (19–49)
Gender			
Male	42 (59.2%)	38 (64.4%)	4 (33.3%)
Female	29 (40.8%)	21 (35.6%)	8 (66.7%)
Family status			
Single	30 (42.3%)	26 (44.1%)	4 (33.3%)
Married	38 (53.5%)	30 (50.8%)	8 (66.7%)
Separated/divorced	2 (2.8%)	2 (3.4%)	
Widowed	1 (1.4%)	1 (1.7%)	
Education			
Public school	24 (33.8%)	20 (33.9%)	4 (33.3%)
High school	22 (31.0%)	19 (32.2%)	3 (25%)
University qualification	24 (33.8%)	20 (33.9%)	4 (33.3%)
Without certificate	1 (1.4%)		1 (8.3%)
Employment status			
Employed	55 (77.4%)	47 (79.73%)	8 (66.7%)
Unemployed	6 (8.5%)	5 (8.5%)	1 (8.3%)
Housewife/student	8 (11.3%)	5 (8.5%)	
Retired	2 (2.8 %)	2 (3.4%)	3 (25%)

between the groups of eligible and rejected candidates according to age ($z = -1.0$; $p = 0.32$), family status ($\chi^2 = 0.68$; $p = 0.88$), education ($\chi^2 = 5.68$; $p = 0.13$) and employment status ($\chi^2 = 4.7$; $p = 0.20$).

Group comparisons. Considering the whole group, the donor candidates (n = 71) had mean values for anxiety (M = 5.17; SD = 4.21) and depression (M = 3.01; SD = 3.55) comparable with a healthy sample ($t = -0.09$; $p = 0.93$ for anxiety and $t = -0.64$; $p = 0.52$ for depression). Eligible and rejected donors did not differ from each other regarding anxiety and depression ($p = 0.94$ for anxiety and $p = 0.62$ for depression). Scores for mental quality of life for the whole sample (M = 49.93; SD = 9.85) were comparable with the German normative sample ($t = -1.38$; $p = 0.17$), but eligible donors exhibited higher values ($z = -2.22$; $p = 0.03$) compared with rejected candidates, indicating better mental quality of life. The group differences were significant on the subscales "psychological well-being" and "emotional role function." In contrast to norm values, rejected donors stated lower mental quality of life ($t = -2.28$; $p = 0.04$). Scores for physical quality of life were higher than normative values for the whole group ($t = 8.01$; $p < 0.01$), indicating a very good physical quality of life; there were no differences between eligible and rejected donors ($z = -0.83$; $p = 0.41$).

Scores for sense of coherence (M = 5.24; SD = 0.65) were similar to those of a normative sample ($t = 1.78$; $p = 0.80$), but the eligible candidates exhibited higher SOC scores than rejected donors ($z = -2.19$; $p = 0.02$). There were no significant differences in the mean values of the sense of coherence for male and female donor candidates ($t = -4.92$; $p = 0.62$).

In social support however donors scored significantly higher than the norm (M = 4.54; SD = 0.49; $t = 8.23$; $p < 0.01$), but no difference between eligible and rejected donors could be found ($z = -0.79$; $p = 0.43$). In addition, females scored higher compared with male donors ($t = 2.48$; $p = 0.02$). Mean values are depicted in Fig. 1.

Correlational analysis. Higher age was correlated to higher scores of sense of coherence. In contrast, there was no relationship between social support and age. There was an inverse correlation between scores of sense of coherence and depression in addition to anxiety scores. Sense of coherence was significantly correlated with mental quality of life and social support.

There was an inverse correlation between social support and depression scores. There was no significant correlation between social support and anxiety, neither was social support correlated to mental quality of life. The correlation matrix is depicted in Table 3.

Multiple hierarchical regression analysis. Prediction of depression and mental quality of life: Age, education, sense of coherence and social support as potential predictors of depression were included in a hierarchical multiple regression model. The

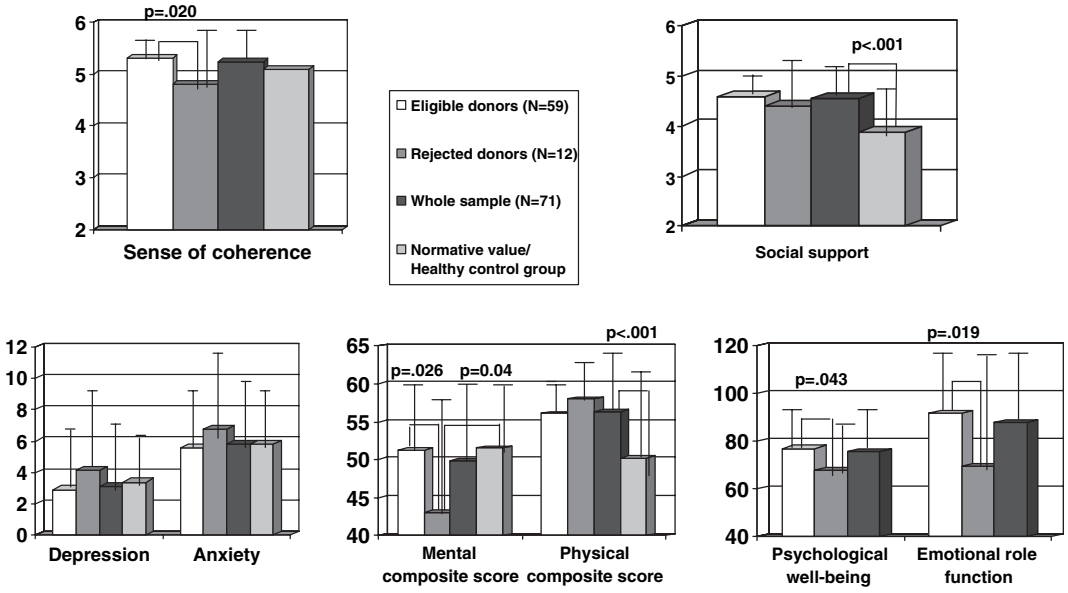

Fig. 1. Mean values of the sample.

Table 3. Correlation matrix

	Age	Sense of coherence	Social support	Depression	Anxiety
Sense of coherence	0.41*				
Social Support	−0.06	0.28**			
Depression	0.04	−0.40*	−0.36*		
Anxiety	−0.03	−0.30**	−0.02	0.79*	
Emotional quality of life	−0.10	0.34*	0.19	−0.72*	−0.69*

*Correlation is significant on a 0.01 level.
**Correlation is significant on a 0.05 level.

Table 4. Multiple regression analysis

Dependent variable	Significant predictors	beta	*t*	p
HADS-Depression ($R_2 = 0.22$)[a]	1. Sense of coherence	−0.281	−2.17	0.034
	2. Social support	−0.326	−2.40	0.020
Sf-36 Emotional quality of life ($R_2 = 0.09$)[a]	1. Sense of coherence	−0.297	2.33	0.023

Independent variables in each regression model: age, education, sense of coherence, social support.
[a]Variance of the model.

regression analysis revealed a highly significant result ($p < 0.001$). Social support and sense of coherence as two significant independent variables explained 22% of the variance in depression scores. A second multiple regression analysis using mental quality of life scores as the criterion variable and the aforementioned covariates as possible predictors explained 9% of the variance with sense of coherence as a significant predictor of the mental quality of life. Results of the regression analyses are depicted in Table 4.

Prediction of anxiety: Under these model assumptions, anxiety scores could not be predicted through the covariates; however, using only sense of coherence as a predictor variable, 6% of the variance of anxiety scores were explained ($\beta = -0.24$; $p = 0.05$).

Discussion

To date the selection of candidates for living donation both for living liver and kidney donation are based on clinical interviews, and several groups (34, 44, 45) have recommended guidelines for the evaluation. We have explored if sense of coherence and social support as protective factors of mental health have predictive value on perceived emotional stress of the donor candidates.

Significantly, more women were excluded from donation because of psychosomatic reasons. A gender disparity has been reported in living kidney donation with women having a higher motivation and readiness for live organ donation (46). Putatively in some cases, womens' desire to donate is motivated by overemphasized commitment, depressive emotions, or the attempt of restitution of self-esteem, which might have led to a rejection of these donors.

It is surprising but familiar that the mean values of anxiety and depression and of mental quality of life are comparable with a healthy (HADS) or normative (SF-36) sample if we look at the whole group of live donors. Previous research of our group has shown (7) that the donors do not show increased emotional stress levels in spite of the stressful life event of donation. This might be attributed to the significantly increased social support that the donors perceive. The significantly higher scores in social support are comprehensible as families are involved and give all possible emotional and practical support to donors and the recipients. It is socially desired to help family members who are in trouble or distress. On the other hand, most candidates are highly motivated for being donors (47) when they apply and want to pass the donor evaluation successfully; therefore, social desirability may influence their responses in the direction of ''normality.'' Sense of coherence is considered as a stable trait marker not reacting to stressful events; therefore, SOC scores comparable to normative samples confirm our expectations (22).

Sense of coherence was correlated to all analyzed variables. Our results confirm our hypothesis that higher scores on sense of coherence are correlated with low levels of anxiety and depression. This finding is in agreement with previous research where sense of coherence is seen as a mediator between actual burden and the degree of psychopathological symptoms expressed (18). Furthermore, when actual burdening factors are heavy, perceived stress may nevertheless not be high if the

respective person has a good sense of coherence at his or her disposal (18–21).

The presumed relationship between social support and emotional distress could only be verified for depression; there were no correlations between perceived social support and anxiety, nor between social support and mental quality of life. Previous studies confirmed the correlation between social support and depression. Depressive symptoms can be modulated and reduced through social support, when people are under stress (29, 30). In particular, impulses of social withdrawal can be compensated through social offers (33). The relationship between anxiety and social support was not of statistical significance. This fact can be seen as in line with our clinical observation that donors express worries and concern about the health problems of the recipient as the most important affairs for themselves and are hardly concerned with their own anxiety in view of the impending operation.

Finally, in a comparison of eligible donor candidates and candidates who were not recommended for transplantation, eligible candidates scored significantly higher on sense of coherence. This finding provides strong evidence in favor of our impression that sense of coherence may be a sound mediator variable to predict mental stability and good coping when stress arises. In contrast to our assumptions, social support did not differentiate between eligible and rejected candidates.

In accordance with these findings are the results of the multiple regression analyses that sense of coherence and social support yielded a clearing up of depression score variance of 22%. Sense of coherence and social support are significant predictors of depression in LDLT donors.

Emotional quality of life and anxiety could only be predicted through sense of coherence, not by social support. Although social support is another key factor in the maintenance of mental health, it may be more effective in the modulation of depressive affects than of anxiety.

Limitations

Our sample for the rejected donors is relatively small. In a prospective study design, it should be investigated if donors with higher SOC scores have more satisfying outcomes after LDLT. Furthermore, our findings need replication.

Conclusions

The psychosocial selection of living organ donors and especially live liver donors would remain a compound job for the psychosomatician and the clinical transplant team. The SOC proved to be a good predictor of all outcome variables; social support only predicted depression. The decision of exclusion or nomination of a candidate as a donor cannot be based on the psychometrical measurements solely, because the interview with the donor candidate includes very important information, such as previous mental problems, donors' motivation and relationship to the recipient. Although they cannot replace clinical interviews, sense of coherence and social support can be implemented as self-rating instruments in the psychosomatic selection of donors and will help to further objectify donors' mental stability and eligibility.

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